CMP408 – The Thirsty Plant Pi

Tia C

BSc (Hons) Ethical Hacking

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Introduction

This project is a scaled-down version of an IoT agriculture solution to monitor the growth of crops and soil moisture levels. This project has been built using a Raspberry Pi Zero with a camera and soil moisture sensor, as well as AWS Lambda, S3 buckets and Twitter Developer API.

The ThirstyPlantPi has both online and offline functionality, making use of hardware, software and cloud abilities throughout the project.

The ThirstyPlantPi's main objectives for the IoT aspect are:

- *Check the moisture level each hour*
- *If soil is wet, light green LED for two seconds and turn off.*
- *If soil is dry, take photo of plant and send to S3 bucket.*
- *AWS Lambda posts most recent photo and status to twitter to notify user.*

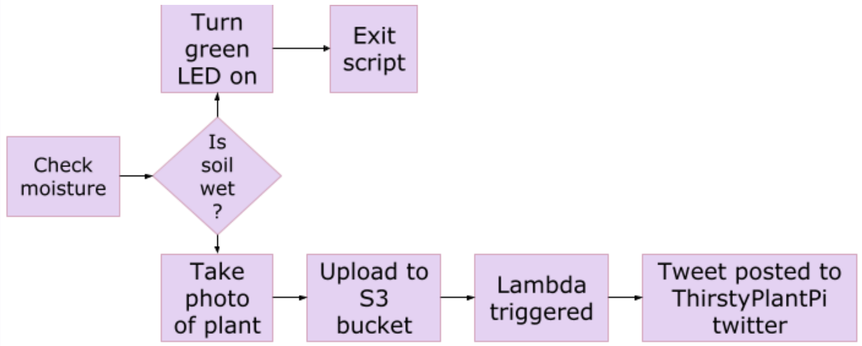
The ThirstyPlantPi's main objectives for the offline/manual aspect are:

- *Process button press as interrupt through LKM*
- *Run python script to check moisture level in plant.*
- *If soil is wet, light green LED for five seconds and turn off.*
- *If soil is dry, light red LED for five seconds and turn off.*

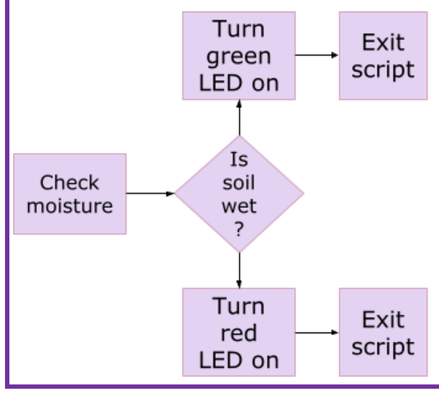
Methodology

The project is built to check the moisture level on a regular basis for the IoT aspect of the project. There is a button for users to manually check the moisture if they do not have access to a smartphone or simply want to check the soil moisture. Unfortunately, the button does not work due to the LKM not being able to be loaded into the kernel, so the terminal is used to run the manual script currently.

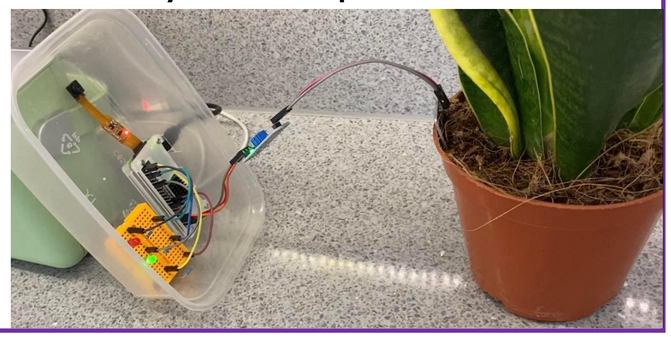
Online Procedure



Offline Procedure



ThirstyPlantPi Setup with Snake Plant



Project Highlights

Overall, the project works as expected and utilises software, hardware and cloud to build a successful IoT agriculture device that works both online and offline.

Some highlights of this project include:

- *Incredibly low cost for AWS services, $0.40 out of $100 allowance used for whole project.*
- *Posting to twitter/tactile button allows other people in household to be able to check plant status*
- *LKM can execute a userspace program without compromising the security of the kernel and operating system.*

Future Work

An automatic irrigation system to water the plant when the sensor cannot detect moisture had originally been planned to be built into the project. However, due to time constraints with ordering and receiving equipment, this was not feasible but would have been implemented to further imitate a small scale IoT agriculture solution.

Due to the Makefile not working as expected, the LKM does not work. Given more time, this issue would be investigated and fixed allowing the button to work as an interrupt to run the script.

References

Technology News Wales. 2022. [online] Available at: <https://businessnewswales.com/how-iot-technology-is-helping-to-revolutionise-the-agriculture-sector/> [Accessed 14 January 2022]., Haque, M., Haque, S., Sonal, D., Kumar, K. and Shakeb, E., 2021. Security Enhancement for IoT Enabled Agriculture. *Materials Today: Proceedings*,., Boto3.amazonaws.com. 2022. *Credentials — Boto3 Docs 1.20.37 documentation*. [online] Available at: <https://boto3.amazonaws.com/v1/documentation/api/latest/guide/credentials.html> [Accessed 2 January 2022]. DEV Community. 2022. *A comprehensive guide for using the Twitter API v2 with Tweepy in Python*. [online] Available at: <https://dev.to/twitterdev/a-comprehensive-guide-for-using-the-twitter-api-v2-using-tweepy-in-python-15d9> [Accessed 3 January 2022]. DEV Community. 2022. *Building a Twitter Bot with Python and AWS Lambda*. [online] Available at: <https://dev.to/jeannienguyen/building-a-twitter-bot-with-python-and-aws-lambda-27jg> [Accessed 3 January 2022].